Physics	Group-II	Paper-I
Time: 1.45 Hours	(Subjective Type)	Marks: 40

(Part-I)

2. Write short answers to any FIVE (5) questions: 10

(i) Define physical sciences and biological sciences.

Ans Physical Sciences:

Physical sciences deal with the study of non-living things.

Biological Sciences:

Biological sciences are concerned with the study of living things.

(ii) What is meant by physical quantities? Give two examples.

Ans All measurable quantities are called physical quantities. Such as length, mass.

(iii) What is meant by prefixes?

Ans Prefixes are the words or letters added before S units such as kilo, mega, giga and milli.

(iv) Define velocity and write its S.I. unit.

Ans The rate of displacement of a body is called its velocity

$$\text{Velocity} = \frac{\text{Displacement}}{\text{time}}$$

$$v = \frac{S}{t}$$

(v) Define vibratory motion and give its example.

Ans To and fro motion of a body about its mean position is known as vibratory motion.

Example:

The motion of the string of a sitar, pendulum of a clock see saw are example of vibratory motion.

(vi) **State Newton's third law of motion and write two examples.**

Ans To every action, there is always an equal but opposite direction.

Example:

1. Consider a book lying on a table. The weight of the book is acting on the table in the downward direction. This is the action. The reaction on the table acts on the book in the upward direction.
2. Take an air-filled balloon. When the balloon is set fear, the air inside it rushes out and the balloon moves forward.

(vii) **What is meant by tension in a string?**

Ans The force acting along a string is called tension in a string.

(viii) **Define coefficient of friction and write its equation.**

Ans The ratio between the force of limiting friction F_s and the normal reaction R is constant. This constant is called the coefficient of friction and is represented by μ.

$$\mu = \frac{F_s}{R}$$

3. Write short answers to any FIVE (5) questions: 10

(i) **Why are vehicles made heavy at the bottom?**

Ans Vehicles are made heavy at the bottom. This lowers their center of gravity and helps to increase their stability.

(ii) **What is meant by neutral equilibrium?**

Ans If a body remains in its new position when disturbed from its previous position, it is said to be in a state of neutral equilibrium.

(iii) **What are the natural satellites?**

Ans A natural satellite or moon is, in the most common usage, an astronomical body that orbits a planet or minor

planet. In solar system, there are six planetary satellites systems containing 185 known natural satellite.

(iv) What is the value of 'g' at moon and mars?

Ans The value of 'g' at moon is 1.62 ms^{-2} and value of 'g' at mars is 3.73 ms^{-2}.

(v) What is difference between 'g' and 'G'?

Ans 'G' stands for Newton's universal gravitational constant. The value of G is 6.673×10^{-11} Nm^2 Kg^{-2}. Whereas, 'g' stands for the acceleration due to gravity at certain point. Its value is 9.8 ms^{-2}.

(vi) What is the second name of solar cell and how is it made?

Ans A solar cell also called photo cell is made from silicon wafer. When sunlight falls on a solar cell, it converts the light directly into electrical energy.

(vii) Define energy and write its S.I unit.

Ans A body possesses energy if it is capable to do work. Its S.I unit is Joule.

(viii) On which factors, work depends?

Ans Work is a scalar quantity. It depends on the force acting on a body, displacement of the body and the angle between them.

4. Write short answers to any FIVE (5) questions: 10

(i) State Pascal's Law.

Ans Pascal's law is stated as:

"Pressure applied at any point of a liquid enclosed in a container, is transmitted without loss to all other parts of the liquid."

(ii) State Archimedes Principle.

Ans Archimedes Principle states that:

"When an object is totally or partially immersed in a liquid, an upthrust acts on it equal to the weight of the liquid it displaces."

(iii) Define elasticity and stress.

Ans **Elasticity:**

The property of a body to restore its original size and shape as the deforming force ceases to act is called elasticity.

Stress:

The force acting on unit area at the surface of a body is called stress. SI unit of stress is Newton per square meter (Nm^{-2}).

(iv) Define lower and upper fixed points.

Ans The lower fixed point is marked to show the position of liquid in thermometer when it is placed in ice. Similarly, upper fixed point is marked to show the position of liquid in thermometer when it is placed in steam at standard pressure above boiling water.

(v) Write two applications of thermal expansion.

Ans Following are the two applications of thermal expansion:

1. In thermometers, thermal expansion is used in temperature measurements.
2. To join steel plates tightly together, red hot rivets are forced through holes in the plates. The end of hot rivet is then hammered. On cooling, the rivets contract and bring the plates tightly gripped.

(vi) Define conduction.

Ans The mode of transfer of heat by vibrating atoms and free electrons in solids from hot to cold parts of a body is called conduction of heat.

(vii) Define convection.

Ans Transfer of heat by actual movement of molecules from hot place to a cold place is known as convection.

(viii) Define radiation.

Ans Radiation is the mode of transfer of heat from one place to another in the form of waves called electromagnetic waves.

(Part-II)

Note: Attempt any TWO (2) questions.

Q.5.(a) How can you relate a force with the change of momentum of a body and prove that: (4)

$$\frac{P_f - P_i}{t} = F$$

Ans **Derivation of equation:**

Consider a body of mass m moving with initial velocity v_i. Let a force F acts on the body which produces an acceleration a in it. This changes the velocity of the body. Let its final velocity after time t becomes v_f. If P_i and P_f be the initial momentum and final momentum of the body related to initial and final velocities respectively then

$$P_i = mv_i$$

and $$P_f = mv_f$$

$\therefore$ Change in momentum = final momentum – initial momentum

or $$P_f - P_i = mv_f - mv_i$$

Thus the rate of change in momentum is given by:

$$\frac{P_f - P_i}{t} = \frac{mv_f - mv_i}{t}$$

$$= m\frac{v_f - v_i}{t}$$

Since $\frac{v_f - v_i}{t}$ is the rate of change of velocity equal to the acceleration a produced by the force F.

$$\therefore \quad \frac{P_f - P_i}{t} = m\,a$$

According to Newton's second law of motion,

$$F = ma$$

or $$\frac{P_f - P_i}{t} = F$$

Equation above also defines force and states Newton's second law of motion as:

"When a force acts on a body, it produces an acceleration in the body and will be equal to the rate of change of momentum of the body."

SI unit of momentum defined by above equation is Newton-second (Ns) which is the same as $kgms^{-1}$.

(b) A train slows down from 80 Kmh^{-1} with a uniform retardation of 2 ms^{-2}. How long will it take to attain a speed of 20 Kmh^{-1}? (5)

Ans

$$v_i = 80\ kmh^{-1}$$

$$= \frac{80 \times 1000\ m}{60 \times 60\ s}$$

$$= 22.2\ ms^{-1}$$

$$v_f = 20\ kmh^{-1}$$

$$= \frac{20 \times 1000\ m}{60 \times 60\ s}$$

$$= 5.6\ ms^{-1}$$

$$a = -2\ ms^{-2}$$

$$t = ?$$

Using equation, we get

$$v_f = v_i + at$$

or $$t = \frac{v_f - v_i}{a}$$

$$= \frac{5.6\ ms^{-1} - 22.2\ ms^{-1}}{-2\ ms^{-2}}$$

or $$t = 8.3\ s$$

Thus, the train will take 8.3 s to attain the required speed.

Q.6.(a) Define equilibrium and explain its three states. (4)

Ans Equilibrium:

"A body is said to be in equilibrium if no net force acts on it."

There are three states of equilibrium:

1. Stable Equilibrium:

"A body is said to be in stable equilibrium if after a slight tilt it returns to its previous position." Its centre of gravity of the body is at the lowest position.

Consider a book lying on the table. Tilt the book slightly about its one edge by lifting it from the opposite side. It returns to its previous position when sets free. Such a state of the body is called stable equilibrium. Thus,

2. Unstable Equilibrium:

"If a body does not return to its previous position when sets free after a slightest tilt, it is said to be in unstable equilibrium." Its centre of gravity of the body at its highest position.

Take a pencil and try to keep it in the vertical position on its tip. Whenever you leave it, the pencil topples over about its tip and falls down. This is called the unstable equilibrium. In unstable equilibrium, a body may be made to stay only for a moment. Thus,

3. Neutral Equilibrium:

"If a body remains in its new position when disturbed from its previous position, it is said to be in a state of neutral equilibrium." Its centre of gravity of the body remains at the same height.

Take a ball and place it on horizontal surface. Roll the ball over the surface and leave it after displacing from its previous position. It remains in its new position and does not return to its previous position. This is called neutral equilibrium.

(b) Calculate the power of a pump which can lift 200 kg of water through a height of 6 m in 10 seconds. (5)

Ans

Mass of water = m = 200 kg
Height attained = h = 6 m
Time taken = t = 10 s
Power of pump = P = ?

We know

$$F = w$$
$$F = mg$$
$$F = 200 \times 10$$
$$F = 2000 \text{ N}$$

We know that

$$P = \frac{W}{t} = \frac{F \times S}{t}$$

$$P = \frac{2000 \times 6}{10}$$

$$P = \frac{12000}{10}$$

$$\boxed{P = 1200 \text{ W}}$$

Q.7.(a) Define specific heat. How would you find the specific heat of a solid? (4)

Ans **Specific Heat:**

"Specific heat of a substance is the amount of heat required to raise the temperature of 1 kg mass of that substance through 1 K."

Generally, when a body is heated, its temperature increases. Increase in the temperature of a body is found to be proportional to the amount of heat absorbed by it. It has also been observed that the quantity of heat ΔQ required to raise the temperature ΔT of a body is proportional to the mass m of the body. Thus,

$$\Delta Q \propto m \Delta T$$

or $$\Delta Q = cm \Delta T \quad \text{(i)}$$

Here ΔQ is the amount of heat absorbed by the body and c is the constant of proportionality called the specific heat capacity or simply specific heat.

Mathematically,

$$c = \frac{\Delta Q}{m \Delta T} \quad \text{(ii)}$$

In SI units, mass m is measured in kilogram (kg), heat Δ Q is measured in joule (J) and temperature increase Δ T is taken in kelvin (K). Hence, SI unit of specific heat is J kg^{-1} K^{-1}.

b) The head of a pin is a square of side 10 mm. Find the pressure on it due to a force of 20 N. (5)

Ans For Answer see Paper 2018 (Group-I), Q.7.(b).